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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/669,660	09/25/2003	Hiroyuki Nishiyama	Q77562	5210

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EXAMINER	
SODERQUIST, ARLEN	
ART UNIT	**PAPER NUMBER**
1743	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	04/03/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

5

Office Action Summary	Application No.	Applicant(s)
	10/669,660	NISHIYAMA ET AL.
	Examiner	**Art Unit**
	Arlen Soderquist	1743

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-22 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-22 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date 9-25-03, 1-16-04, 3-19-04.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.

5) ☐ Notice of Informal Patent Application

6) ☒ Other: IDS received 3-8-07.

1. Applicant is advised that should claim 1 be found allowable, claim 22 will be objected to under 37 CFR 1.75 as being a substantial duplicate thereof. When two claims in an application are duplicates or else are so close in content that they both cover the same thing, despite a slight difference in wording, it is proper after allowing one claim to object to the other as being a substantial duplicate of the allowed claim. See MPEP § 706.03(k).

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 1-3, 9-10 and 19-22 are rejected under 35 U.S.C. 102(b) as being clearly anticipated by Raju. In the paper Raju teaches MoO_3/TiO_2 and Bi_2MoO_6 materials as ammonia sensors. Ammonia (NH_3) sensors based on catalytic oxides such as V_2O_5, MoO_3 and α-, β- and γ-bismuth molybdates have been investigated. MoO_3 (15 mol%) supported on TiO_2 and γ-Bi_2MoO_6 both exhibit satisfactory sensing characteristics for NH_3, with a reasonably low working temperature (500-575 K) and a minimum detection limit of 10 ppm. Humidity has no measurable effect on the performance of these materials. ESR studies show the formation of Mo^{5+} species on these oxides on contact with NH_3. The paragraph bridging the columns of page 23 teaches that V_2O_5 and MoO_3 dispersed in titanium dioxide are known oxidation catalysts and that Bi_2MoO_6 is a known oxidation and amoxidation catalyst. This paragraph also teaches that at least the bismuth molybdate films have been suggested as gas sensing materials for reducing gases that may produce mobile oxygen deficiencies in the molybdate. The first paragraph under the experimental section teaches the production of the powdered materials by first hydrolyzing titanium chloride in liquid ammonia and calcining in air followed by impregnating the titanium dioxide powder with an ammonium heptamolybdate solution, drying and calcining to produce the titanium dioxide supported molybdate at 5, 10, 15 and 20 mol%. This method appears to be equivalent to that disclosed for the production of the instantly claimed materials and the titanium dioxide supported molybdate is anticipatory of the claimed material. The first paragraph of page 24 teaches the formation of oxide wafers and addition of electrodes with conducting paint. Figure 1 shows the sensitivity of the titanium dioxide supported molybdate materials to ammonia.

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* v. *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

5. Claims 1-3, 9-10 and 13-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Raju as applied to claims 1-3, 9-10 and 19-22 above, and further in view of Kornely (EP 1008847) or Yamazoe (JP 4-29049). Raju does not teach other materials for an ammonia sensor or supporting the MoO_3/TiO_2 material on a support.

In the published application Kornely teaches resistance-based gas sensors with WO3-TiO_2 active layer for determination of NO_x in automobile exhaust gases. A resistive gas sensor with good mechanical and thermal resistance, that is especially suitable for detection of NO, NO_2, NH_3, or hydrocarbons in an automobile exhaust gas, consists of a gas-sensitive layer, a corresponding measuring electrode, and a heating unit, in which the gas-sensitive layer consists of a mixture of WO_3 and TiO_2, which is prepared by crystallizing WO_3 around a nucleus of TiO_2. The gas-sensitive layer (5-50 μm thick), which contains $\geq$50 weight% WO_3, can be prepared by the sol-gel method using tungstic acid salt (M_2WO_4, in which M = H, Na, K, or NH_4) precursors, or can be prepared from $Ti(OC_3H_7)_4$ and WCl_6 precursors. The gas sensor is also connected to an oxidation catalyst consisting of an impregnated metal oxide support (e.g., γ-Al_2O_3, SiO_2, or TiO_2 impregnated with a noble metal, such as Pt, Rh, Pd, or Ir) or a pure metal oxide catalyst (e.g., TiO_2-V_2O_5 containing CuO or MnO_2).

In the published application Yamazoe teaches a gas sensor having as its purpose, increasing the sensitivity of the sensor and to improve its response speed and recovery rate by

adding one kind of acidic oxide catalysts having a large electronegativity to one kind of metal oxides which are the essential components in the constitution of a metal oxide semiconductor. The metal oxide semiconductor (4) is constituted by adding one kind among the acidic oxides, such as V_2O_5 and Cs_2O as a catalyst, to one kind of the metal oxides, such as SnO_2 and TiO_2, which are the essential components of the constituting materials. Namely, an aqueous solution of $SnCl_4$ is first neutralized by ammonia water to obtain β-stannic acid and after this acid is rinsed, filtered and dried, the acid is calcined for about 5 hours at about 600 °C in air to obtain the powder sample of SnO_2. One kind of the acidic oxide catalysts, such as V_2O_5 and Cs2O, are added thereto by an impregnation method and the sample is calcined for about 5 hours at about 600 °C. The powder obtained in such a manner is kneaded together with a vehicle and the mixture is molded; thereafter, the molding is calcined to form the semiconductor (4). Noble metals, such as Pt, may be added together with the V_2O_5, Cs_2O, etc., or alone. The sensitivity of the sensor is greatly increased in this way and the response speed and recovering rate are improved. The title sensors use changes of electrical resistance accompanied with gas-adsorption and -desorption with metal oxide semiconductors which comprise metal oxide (as main component) of SnO_2, TiO_2, Fe_2O_3, In_2O_3, NiO, CoO, ZnO, or $MgFe_2O_4$; and additives of catalyst of V_2O_5, P_2O_5, MoO_3, Cs_2O, or WO_3, or Ru, Pt, or Ag. The sensors are useful for detection of basic gases, especially, NH_3. Thus, 5 ppm NH_3 was detected by a sensor prepared from SnO_2 and V_2O_5. The table shows tin dioxide materials with molybdenum and tungsten additives. Figures 1-2 show supported sensing films.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use a titanium supported tungsten material as taught by Kornely or Yamazoe in the Raju sensor because it is ammonia sensitive and can be supported on an inert heater containing substrate and has good mechanical and thermal resistance as taught by Kornely and Yamazoe. It would have been obvious to one of ordinary skill in the art at the time the invention was made to use other oxides as taught by Yamazoe to support the molybdenum and tungsten materials in the Raju device because as shown and taught by Yamazoe the materials are sensitive to ammonia and show an increased sensitivity and response and recovery properties as taught by Yamazoe.

6. Claim 12 rejected under 35 U.S.C. 103(a) as being unpatentable over Raju as applied to claim 1 above, and further in view of Inoue (JP 2000-5584). Raju does not teach a protective layer.

In the published application Inoue teaches a semiconductor gas sensor. The title semiconductor oxide gas sensor is used for analysis of atmospheric gas based on the measurement of the electrical resistivity variation corresponding to the gas concentration. The sensor is made by forming a pair of electrodes on the surface of a ceramic substrate and a semiconductor oxide member disposed on the substrate connected with the electrodes and having its electrical resistivity vary corresponding to the gas concentration. A diffusion control layer on the substrate is used to control the passage of the sample gas diffusing from the atmosphere to the semiconductor oxide. The diffusion control layer is made by spraying particles of an insulative material on the semiconductor oxide surface to a thickness of 0.1-0.3 mm. The diffusion layer improves a response property of the sensor by suppressing the overshooting of the resistance change in an oxide semiconductor. Paragraph [0003] appears to list ammonia as one of the possible gases to be sensed.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to provide a diffusion control layer as taught by Inoue on the Raju sensing material because of the ability of the layer to improve the response properties of the device as taught by Inoue.

7. Claims 1-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Schmelz (US 5,546,004) in view of Raju as explained above and Wang (US 2002/0146352). In the patent Schmelz teaches a sensor for determining the course of concentration of an adsorbent substance, such as ammonia NH_3, diffusing out of a flow medium through a surface of a sensor material into the sensor material, as a function of a distance from the surface. Individual pairs of contacts are connected to supply leads and are disposed in the sensor material and optionally on the surface of the sensor material, for determining electrical conductivity of the sensor material between the contacts of the individual pairs of contacts. The concentration of NH_3 is determined on the basis of conductivity in flue gas and exhaust gas streams to be contacted with catalysts, using sensors from TiO_2 and $\trianglerighteq$ of WO_3, MoO_3, V_2O_5, and $V_xMo_yO_{32-z}$ where $x+y \trianglelefteq 2$, $x,y \trianglerighteq$ and $z \trianglelefteq$. Column 4, lines 16-31 teach that in order to make the sensor especially sensitive to a

reducing agent, especially ammonia, urea, or the like, the sensor material includes an oxide having a pH value of less than 7. In oxides with these pH values, the electrical conductivity of the sensor material varies within such limits that it is possible in a simple way, in terms of measuring instruments, to determine the concentration of the adsorbed reducing agent from differences in conductivity. This is followed by a listing of the above materials as materials meeting the acidity requirement. The figures show a plurality of sensors supported on an inert substrate with a heater and temperature control structure (figures 1-3 and the associated discussion of columns 5-6). Schmelz does not teach how the materials are made or other acidic materials.

In the published application Wang teaches a poison resistant combustible gas sensing element, a method for its production and a method for determining poisoning of the element. The element includes an electric heating element, an inner layer coated on the electric heating element and containing a precious metal catalyst supported on a porous oxide, the precious metal catalyst catalyzing combustion of a combustible gas to be detected by the element, and an outer layer overlaying the first layer, and containing a catalytic compound capable of trapping gases which poison the precious metal catalyst, the catalytic compound being supported on a porous oxide. Paragraphs [0016], [0020], [0042] and [0046] teach that solid acids or preferably solid superacids are used for trapping by means of strong acidic sites. Paragraph [0048] teaches that these materials can be made by conventional methods such as impregnation. Tungsten oxide/zirconia (WO_x/ZrO_2) and sulfated zirconia (SO_4^{2-}/ ZrO_2) are included in this group of acids.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to make the Schmelz materials in a manner as taught by Raju because of the known sensitivity of materials made in that way to ammonia as shown by Raju. It would have been obvious to one of ordinary skill in the art at the time the invention was made to use other known acid or superacids such as the tungsten oxide/zirconia and sulfated zirconia of Wang as the sensitive material of Schmelz because of their known strong acid sites as taught by Wang and the teaching in Schmelz that having an oxide with an acid pH (a value less than 7) will make the sensor sensitive to ammonia.

8. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. The additionally cited art relates to ammonia sensing or sensing materials.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Arlen Soderquist whose telephone number is (571) 272-1265. The examiner can normally be reached on Monday-Thursday and Alternate Fridays.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jill Warden can be reached on (571) 272-1267. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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Art Unit 1743